MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

BBM3034 – BUSINESS MODELLING AND SIMULATION

(All section/Group)

7 July 2023
9.00 am to 11.00 am
(2 hours)

INSTRUCTION TO STUDENT

1. This question paper consists of **FOUR (4)** pages, excluding the cover page, with **FOUR (4)** structured questions.
2. Marks are shown at the end of each question.
3. Answer all questions.

Answer all questions.

Question One (Total: 25 marks)

(a) Present a detailed explanation of the purpose of simulation modelling. (8 marks)

(b) Produce an explanation of how to set the boundaries of modelling. (6 marks)

(c) Present how you would model uncertainty of the demand for Airbnb apartments in Penang for the month of June May 2022 (Note Yang Dipertuan Agong's birthday on 5 June 2023 and Hari Raya Aidil Adha on 29 June 2023). (11 marks)

Question Two (Total: 25 marks)

Kayaraya Investing Sdn Bhd is an investment company investing in Malaysia's capital market. In the beginning of year 1, Kayaraya has RM1 million to invest for the next four years. There are five possible investment portfolios, labelled A through E. The timing of cash outflows and cash inflows for these investments is somewhat irregular. The maximum amount to invest in one investment portfolio is limited to RM250,000.

To take part in investment A, cash must be invested at the beginning of year 1, and for every ringgit invested, there are returns of RM0.08 and RM0.11 at the beginning of years 2 onwards.
Investment B: Invest at the beginning of year 2, receive returns of RM0.10 and RM0.15 at the beginning of years 3 and 4.
Investment C: Invest at the beginning of year 1, receive return of RM0.18 at the beginning of year 2 and 4.
Investment D: Invest at the beginning of year 4, receive return of RM0.19 at the beginning of year 5.
Investment E: Invest at the beginning of year 3, receive return of RM0.22 at the beginning of year 4.

The objective of Kayaraya Investing is to maximise total ending cash. Based on all the information above, the solver solution is illustrated in Worksheet 1 below.

Answer the following questions.

(a) Present your answer to the following questions.

i. Ringgit invested in each investment portfolio A to E. (2 marks)

ii. The maximum amount of cash (ringgit) invested in the capital market. (2 marks)

(b) Solve the following cash balance for Kayaraya Investing.

i. Return from investments for Year 3. (3 marks)

ii. Return from investments for Year 4. (3 marks)

iii. The maximum final cash holding at the beginning of Year 5. (4 marks)

iv. Total ringgit invested in the capital market (3 marks)

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Worksheet 1: Kayaraya Investing

Initial amount to invest	RM1,000,000					
Maximum per investment	RM250,000					
Interest rate on cash	5%					
Cash outlays on investments (all incurred at beginning of year)						
	Investment					
Year	A	B	C	D	E	
1	RM1.00		RM1.00			
2		RM1.00				
3					RM1.00	
4				RM1.00		
Cash returns from investments (all incurred at beginning of year)						
	Investment					
Year	A	B	C	D	E	
1						
2	RM0.08		RM0.18			
3	RM0.11	RM0.10				
4	RM0.11	RM0.15	RM0.18		RM0.22	
5	RM0.11			RM0.19		
Investment decisions						
Ringgit invested	RM250,000	RM250,000	RM250,000	RM250,000	RM250,000	
	<=	<=	<=	<=	<=	
Maximum per investment	RM250,000	RM250,000	RM250,000	RM250,000	RM250,000	
Constraints on cash balance						
Year	Beginning cash	Returns from investments	Cash invested	Cash after investing		
1	RM1,000,000	RM0	RM500,000	RM500,000	>=	0
2	RM525,000	RM65,000	RM250,000	RM340,000	>=	0
3	RM357,000	a (i)	RM250,000	RM159,500	>=	0
4	RM167,475	a (ii)	RM250,000	RM82,475	>=	0
5	a (iii)	a (iii)				

(c) Refer to Table 1 to predict the change in cash after investing in Year 2 when RM340,000 is invested in the capital market. (4 marks)

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Table 1: Sensitivity Analysis

Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
Cash after investing Year 1	500000	0	0	500000	1E+30
Cash after investing Year 2	340000	0.02	0	340000	1E+30
Cash after investing Year 3	159500	0	0	159500	1E+30
Cash after investing Year 4	82475	0.03	0	82475	1E+30

(d) Similarly, predict the change in cash after investing in Year 4 when RM82,476 is invested in the capital market. (4 marks)

Question Three (Total: 25 marks)

AEON Credit, credit card company, currently has 75 per cent retention rate. On average, each cardholder spends RM1,500 per month and the average profit margin generated from each cardholder is 15% per year.

AEON initiates a promotion campaign in Year 2 through two promotion teams. Promotion Team 1 will incur a promotion cost of RM50 for each new card issued and Promotion Team 2 RM40 each. AEON Credit promotion budget is RM9,000 per year. Promotion Team 2 capacity is 100 new cardholders.

Based on 1,000 cardholders in Year 1 and a minimum 200 new cardholders joining AEON Credit, the optimised model is illustrated in Table 2.

Table 2: AEON Card promotion

AEON Credit				
Prob leave	0.25			
Prob retain	0.75			
Promotion budget	RM9,000.00			
	Promotion team 1	Promotion team 2		
	50	40		
New Cardholders	100	100	>=	200
Total	RM5,000.00	RM4,000.00	<=	RM9,000.00
Profit margin	0.15			
Average usage per cardholder	RM1,500			
	AEON	Promotion cost	Profit	
Year 1	1,000			
Year 2	950	RM 9,000.00	RM 204,750.00	
Year 3	913	RM 9,000.00	RM 196,312.50	
Year 4	884	RM 9,000.00	(a)	
Year 5	863	RM 9,000.00	(a)	

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(a) Predict AEON Credit's profit for Year 4 and Year 5. (4 marks)
(b) Present **two** problems with the deterministic model presented in Table 2. (6 marks)
(c) Suppose that the probability of retaining cardholders varies in a way that 33% chance that 75% of AEON cardholders can be retained, 28% chance that 80% of AEON cardholders can be retained, 24% of 85% of AEON cardholders can be retained and the remaining can retain 90% of AEON cardholders. Present the cumulative probability to run a 100-simulation. (5 marks)
(d) A 100-simulation output is illustrated in Table 3.

Table 3 : Simulation

Simulation	Retention	Year 2	Year 3	Year 4	Year 5	Profit
1	0.75	RM950.00	RM912.50	RM863.28	RM863.28	RM798,539.06
2	0.8	RM1,000.00	RM960.00	RM907.50	RM907.50	RM840,375.00
3	0.85	RM1,050.00	RM1,007.50	RM951.72	RM951.72	RM882,210.94
4	0.85	RM1,050.00	RM1,007.50	RM951.72	RM951.72	RM882,210.94
5	0.9	RM1,100.00	RM1,055.00	RM995.94	RM995.94	RM924,046.88
97	0.75	RM950.00	RM912.50	RM863.28	RM863.28	RM798,539.06
98	0.8	RM1,000.00	RM960.00	RM907.50	RM907.50	RM840,375.00
99	0.75	RM950.00	RM912.50	RM863.28	RM863.28	RM798,539.06
100	0.75	RM950.00	RM912.50	RM863.28	RM863.28	RM798,539.06
		Average Profit				RM 842,885.16
		Standard Deviation				RM 43,623.32
		Minimum				RM 798,539.06
		Maximum				RM 924,046.88
		90% confidence interval: $\bar{x} \pm 1.645 * (stdev / sqrt(n))$				
		95% confidence interval: $\bar{x} \pm 1.96 * (stdev / sqrt(n))$				
		99% confidence interval: $\bar{x} \pm 2.576 * (stdev / sqrt(n))$				

Based on 95% confidence interval, solve the upper and lower limits of AEON promotion campaign. Interpret your findings. (10 marks)

Question Four (Total: 25 marks)

(a) You have recently saved some money from your part-time job to start investing in Bursa Malaysia. You have decided to invest part of your savings in 5 lots of GHL Systems stock. Although the world is still recovering from the covid19 pandemic, you are expecting to gain at least 5% of return on this investment by the end of three years. Describe how you would develop a simulation model to determine the probability of return to this investment by the end of three years. (20 marks)

(a) Evaluate the following statement, "***Spreadsheet simulations cannot be performed entirely with the built-in or add-in tools in Excel®***". (5 marks)

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